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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/754,390	01/09/2004	Abaneshwar Prasad	100196	7753

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EXAMINER	
MULLER, BRYAN R	

ART UNIT	PAPER NUMBER
3723	

DATE MAILED: 12/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/754,390	PRASAD ET AL.	
	Examiner	Art Unit	
	Bryan R. Muller	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1-9/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-6 and 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties".

3. In reference to claims 1-6, 16 and 17, Reinhardt discloses a polishing pad made of polyurethanes exhibiting the properties of a density greater than .9 g/cm^3, tensile modulus (aka. Young's modulus (E) or modulus of elasticity) between 0.2 and 5 GPa, a hardness between 25 and 80 Shore D, a yield stress between 300 psi (2.07 MPa) and 6,000 psi (41.4 MPa), tensile strength between 500 psi (3.45 MPa) and 15,000 psi (103.4 MPa), and elongation to break up to 500%. The pad disclosed by Reinhardt also comprises abrasive particles of a preferable material selected from a group including silica, alumina, titania, and ceria. Reinhardt fails to disclose that the polyurethane to be used shall be a thermoplastic or thermoset polymer with a Poisson's ratio between -0.8 and -0.2. The BASF Elastollan C-64D Polyurethane Elastomer has the following properties: density = 1.24 g/cm^3, modulus of elasticity = 0.4Gpa, hardness = 64 Shore D, yield stress between 3770 psi and 5510 psi, tensile strength = 5800 psi, elongation to

break = 430%, and a shear modulus (G) = 0.25 GPa. When the modulus of elasticity (E) and shear modulus (G) are applied to the equation disclosed by the applicant relating the two to Poisson's ratio, it is determined that the Elastollan C-64D has a Poisson's ratio = -0.2. Because the Elastollan C-64D exhibits all the properties disclosed in Reinhardt's polishing pad, it would be obvious to one of ordinary skill in the art at the time the invention was made to use the Elastollan C-64D to produce the polishing pad disclosed by Reinhardt. The Elastogran publication "Elastollan – Material Properties" is provided as proof that the Elastollan C-64D was available to public knowledge at the time the Reinhardt invention was made, the publication includes information on several Elastollan polyurethane elastomers, including the C-64D and the publication is dated August 1994. Further, Ellastolan C-64D is a thermoplastic material (classified as a thermoplastic material by www.matweb.com and found in Thermoplastics Publication).

4. In reference to claims 18-20, it would be obvious to one of ordinary skill in the art at the time the invention was made to polish a work piece through the method of: providing a work piece to be polished, contacting the work piece with a chemical-mechanical polishing system comprising the polishing pad discussed supra and abrading at least a portion of the surface of the work piece with the polishing system to polish the work piece.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties" and further in view of Shiro et al ('934).

6. Reinhardt in view of the BASF Elastollan C-64D provides a polishing pad as discussed supra but fails to disclose that the density of the pad should be less than 1 g/cm^3. Shiro, however, discloses a polyurethane polishing pad and teaches that the material used to make the pad should have a density between 0.4 and 1.1 g/cm^3, most preferably between 0.65 and 0.85 g/cm^3. This is the most preferable range because if the density is not at least 0.4, the local planarity is poor and if the density is above 1.1, scratching readily occurs (col. 2, lines 51-57), therefore making 0.65 to 0.85 the optimum range. Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to form the polishing pad from a material exhibiting all the properties of the Elastollan C-64D except for density, where it would be advantageous to have a density between 0.65 and 0.85 g/cm^3 in order to prevent scratching of the work piece.

7. Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties" and further in view of Sevilla et al ('532).

8. Reinhardt in view of the BASF Elastollan C-64D provides a polishing pad as discussed supra but fails to disclose that the pad has a void volume of about 75% or less or that the average pore diameter in the pad is between 0.1 and 2500 μm. Sevilla discloses a polishing pad made of a porous substrate and teaches that an average pore diameter from about 5 to 100 μm (microns) will enhance pad polishing performance (abstract, lines 5-7) and that a porosity or pore volume (void volume) between about

15% and 70%, preferably between 25% and 50%, has been found to yield acceptable polishing pads possessing the necessary flexibility and durability in use (col. 5, lines 28-34). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made that the pad of Reinhardt, made of Elastollan C-64D should possess pores with an average diameter between 5 and 100 μm to enhance pad polishing performance and a porosity between 15% and 70% to provide the polishing pad with the necessary flexibility and durability for use.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties" and further in view of Suzuki et al ('353).

10. Reinhardt in view of the BASF Elastollan C-64D provides a polishing pad as discussed supra but fails to disclose that the pores in the pad should have a pore density greater than about 10 pores/cm. Suzuki discloses a polishing method including a polishing pad and teaches that the surface roughness of the work piece is dramatically improved when finish polishing is conducted using a finish polishing pad with a pore density equal to or higher than a value (col. 3, 8-11) and further discloses a polishing pad with a pore density equal to or higher than 150 pores/cm^2 (approximately 12.2 pores/cm). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made that the pad of Reinhardt, made of Elastollan C-64D should have a pore density greater than or equal to 150 pores/cm^2 in order to dramatically improved the finish of a work piece through polishing.

11. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties" and further in view of Osterheld et al ('596).

12. Reinhardt in view of the BASF Elastollan C-64D provides a polishing pad as discussed supra but fails to disclose that the surface of the polishing pad should comprise of linear grooves in the form of an XY crosshatch. Osterheld discloses a method and apparatus for chemical mechanical polishing using a patterned pad and teaches that a plurality of slurry distribution/retaining grooves are distributed with a first portion extending linearly over the surface of the pad along the x-axis and a second portion extends linearly over the surface of the pad along the y-axis defining an X-Y grid pattern (col. 5, lines 7-14) and that the grooves are adapted to inhibit slurry or other fluids from flowing off the pad during operation. Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made that the pad of Reinhardt, made of Elastollan C-64D should have linear grooves in the form of an XY crosshatch in order to distribute a slurry while preventing the slurry from flowing off the pad during operation.

13. Claims 14, 15and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reinhardt ('902) in view of BASF Elastollan C-64D Polyurethane Elastomer and Elastogran publication "Elastollan – Material Properties" and further in view of Tang ('927),

14. Reinhardt in view of the BASF Elastollan C-64D provides a polishing pad as discussed supra but fails to disclose an optically transmissive region that has a light transmission of at least 10% at one or more wavelengths between 190nm and 3500nm. Tang discloses an *in-situ* monitoring technique for end point detection during chemical mechanical polishing planarization including a polishing pad with an optically transmissive region. Tang teaches that the light source is capable of illuminating in the range of about 200 to 11,000 nm in wavelength and that when the wavelength is measured from the back side of the substrate (opposite light source) the wavelength is preferred to be 1,300 nm (col. 5, lines 6-12) which would be at least 11.8% of the light source being transmitted through the substrate. Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to provide the pad of Reinhardt, made of Elastollan C-64D, with an optically transmissive region that has a light transmission of at least 11.8% at one or more wavelengths between 200nm and 11,000nm to monitor the end point during chemical mechanical polishing. It would also be obvious to polish a work piece by provide a work piece to be polished, contacting the work piece with a chemical mechanical polishing system comprising the pad of Reinhardt, made of Elastollan C-64D with an optically transmissive region and abrading at least a portion of the surface of the work piece with this polishing system.

Response to Arguments

15. Applicant's arguments and the declaration filed on 9/9/2005 have been fully considered but they are still not persuasive. The examiner maintains the argument that

the Elastollan C64D material meets the claimed requirements, based on the defining formulas provided by the applicant in the specification for determining a Poisson's ratio. The values provided by the MatWeb website, when entered into the applicants defining formulas (which are "**always true**" as stated in lines 20 and 21 of page 3 of the argument filed 9/9/2005) provide a value that defines the Elastollan C64D material as a material with a negative Poisson's Ratio. Although the methods for determining the values for the Modulus of Elasticity and Shear modulus of the material are not disclosed on the MatWeb website, the values were provided by BASF (as stated in the last two lines of the Material notes on the MatWeb Elastollan C64D webpage), the maker of the material, which would lead one to believe that the values are correct. Furthermore, the applicant has not provided any indisputable proof that the values are incorrect. Merely arguing that the values are incorrect because they would provide the material with a "very uncommon" property, that the method is not disclosed or that the references do not specifically disclose that the material was treated to provide a negative Poisson's ratio does not disprove the values or overcome the rejection. To overcome the rejection, the applicant will have to provide **factual evidence** that the values for Modulus of Elasticity and Shear Modulus for Elastollan C64D provided by MatWeb are incorrect. The argument that the stress strain relationship of the Elastollan C64D is not the same as stress v. strain diagrams of other materials having a negative Poisson's ratio also fails to provide factual evidence that the Elastollan C64D does not have a negative Poisson's ratio. First, the diagrams of the other Negative Poisson's ration materials are all in different scales than the diagrams provided for the Elastollan C64D,

so it is not possible to determine the exact similarities or differences in the stress v. strain relationships of the Elastollan C64D to the other Negative Poisson's ration materials. Second, the stress v. strain diagrams provided by the applicant are for different materials than Elastollan C64D and it is well known that different materials may react very differently to stress v. strain tests dependent on several factors such as temperature, as seen in fig. 20 in the BASF publication. Further, none of the stress v. strain diagrams for the Elastollan C64D are so similar to any of the stress v. strain diagrams for the standard materials or so different from the materials with negative Poisson's ratio, that the comparison of the stress v. strain diagrams alone can provide **factual evidence** that the Elastollan C64D doe not have a negative Poisson's ratio.

Information Disclosure Statement

16. All of the references provided on the US form 1449 have been considered.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Pinheiro (Pub. '469) and Cook (Pub. '940) disclose polishing pads with properties similar to those disclosed in application and Pecen ('634), Birang ('796) and Katakabe ('046) disclose polishing methods including polishing pads with light transmissive regions for *in-situ* detection methods.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bryan R. Muller whose telephone number is (571) 272-4489. The examiner can normally be reached on Monday thru Thursday and second Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph J. Hail III can be reached on (571) 272-4485. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BRM BRM
11/29/2005

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